REMARKS

Reconsideration of the above-identified patent application is respectfully requested in view of the foregoing amendments and following remarks. Claims 1 and 3 through 5 have been amended and remain in the case.

The invention is a new method of soldering featuring a solder layer that comprises a curved, interrupted, irregular, or interdigitated boundary. The non-planar boundary layer increases the fatigue life of the solder joint by limiting the damage caused by micro-cracking. This irregularity of the solder boundary constrains the propagation of cracks by creating obstacles along the crack path, redirecting the crack away from the intermetallic boundary, and by increasing the path length along which the crack propagates.

The drawings were objected to under 37 C.F.R. §1.83(a). The intermetallic boundary is now identified as reference numeral 15 on Figure 2 and Figure 4 and in the specification in accordance with the Examiner's remarks. A Letter to the Official Draftsman is herewith submitted.

Claims 1 and 3 through 5 were rejected under 35 U.S.C. §112 as being indefinite. The intermetallic boundary is now affirmatively recited in all claims. Reference to a "layer" has been stricken to avoid confusion. Moreover, it is the configuration that disrupts, constrains, and lengthens the crack pathway, thereby increasing fatigue life of the solder joint, as now clearly recited in the claims. Claims 1, 3, and 4 have also been amended to affirmatively recite the solder joint.

Claims 1 and 3 through 5 were rejected under 35 U.S.C. §102(b) as being anticipated by Burns et al., U.S. Patent No. 5,118,299. Burns discloses a method of electrical interconnection for directly connecting (i.e., no solder joints) microcircuits in PCB devices. Rather than being permanently joined, the contact surfaces are attachable and detachable when desired. The electrical interconnection comprises a first and a second contact surface, at least one of which includes a conductive substrate having conical conductors extending substantially perpendicularly therefrom. The conical conductors comprise a core of polymeric material, having a conductive film thereover.

The polymeric cones are formed with a laser removable polymer material, which is disposed in a thickness predetermined to be equal to the desired height of the conical projections. The contact further includes, in electrical contact with the first conductive surface, a substantially electrically continuous conductive material deposited on at least some of the cones.

Burns does not teach or suggest the use of a solder joint having a configuration at an intermetallic boundary to disrupt, constrain, or lengthen the crack pathway, thereby increasing the fatigue life of the solder joint as recited in presently amended claims. In fact, no solder joint is included in Burns at all!

Claims 1 and 3 through 5 were rejected under 35 U.S.C. §102(b) as being anticipated by Herdzik et al., U.S. Patent No. 3,839,727. Herdzik teaches that the introduction of a ternary generating metal such as palladium increases the fatigue life of the solder joint between the semiconductor chip and the ceramic substrate by minimizing failures or cracks due to repeated thermal cycling. This patent deals with heating and cooling the materials and introducing an intermetallic substance to the solder itself. Herdzik has

no statement to the effect that a configuration, including an intermetallic boundary, can be provided or can be used to increase fatigue life.

Herdzik neither teaches nor suggests a solder joint having a configuration at an intermetallic boundary to disrupt, constrain, or lengthen the crack pathway, thereby increasing the fatigue life of the solder joint as recited in presently amended claims.

It is believed that this major difference in structure, as now recited in the claims, traverses the Office's rejection.

A marked-up version is provided hereinbelow indicating deleted subject matter within brackets ([]) and newly-added material with underscores. This marked-up claim is intended to communicate details of the amendments thereto.

In view of the foregoing amendments and remarks, Applicants respectfully request that claims 1 and 3 through 5 be allowed and that the application be passed to issue.

Respectfully submitted,

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner of Patents and Trademarks Washington, D.C. 20231

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(Date of Deposit)

Mark Levy, Reg. 29188 — Date 12/3/02
Attorney

Mark Levy
Registration No. 29,188
Attorney for Applicants
SALZMAN & LEVY
Press Building - Suite 902
19 Chenango Street
Binghamton, New York 13901

Telephone: (607) 722-6600

Version with Markings to Show Changes Made

IN THE SPECIFICATION:

Please replace the paragraph on page 7, lines 7 - 12, with the following amended paragraph:

-- Now referring to Figure 1, a plan view of a prior art metallic pad 10 is illustrated. The straight edge 12 of the solder boundary induces micro-cracking 14 in solder near the intermetallic layer 15, as shown in Figure 2. The micro-crack 14 tends to propagate, because there is no constraint against its growth. --

Please replace the paragraph on page 8, lines 5 - 16, with the following amended paragraph:

-- Referring to Figure 4, a solder joint at the intermetallic boundary 15 is shown, using the serpentine solder configuration depicted in Figure 3a. It will be observed that the respective micro-cracking 20 at each intermetallic boundary 15 is following a circuitous or meandering path. The lengthening of the crack pathway increases the useful life of the solder joint. Other pad

configurations are shown in Figures 3b through 3d. As before, this results in micro-crack pathways which are interrupted, lengthened, or constrained. In a similar manner, these configurations are expected to increase fatigue life of the solder joint, as is that of the solder design shown in Figure 3a. --

IN THE CLAIMS:

1. (Amended) A solder joint, having a configuration at and near an intermetallic boundary [layer that disrupts, constrains, or lengthens cracking] , said configuration for disrupting, constraining, and lengthening the crack pathway at said intermetallic boundary, thereby increasing fatigue life of the solder joint, [comprises] said solder joint comprising a pad having an irregular boundary layer.

3. (Amended) A solder joint, having a configuration at and near an intermetallic boundary [that disrupts, constrains, and lengthens cracking] , said configuration for disrupting, constraining, and lengthening the crack pathway at said intermetallic boundary, thereby increasing fatigue life of the solder joint, [comprises] said solder

joint comprising a solder strip having an interdigitated boundary layer.

4. (Amended) A solder joint, having a configuration at an intermetallic boundary , said configuration for disrupting, constraining, and lengthening the crack pathway [that disrupts, constrains, and lengthens cracking at said intermetallic boundary], thereby increasing fatigue life of the solder joint, [comprises] said solder joint comprising a solder strip having a curved boundary layer.

5. (Amended) A solder joint, having a configuration at and near an intermetallic boundary in accordance with claim 4, wherein said curved boundary layer further comprises a substantially continuous structure.